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FOR

METHOD AND APPARATUS FOR PASSWORD RE-ENTRY

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## BACKGROUND OF THE INVENTION

### 1. FIELD OF THE INVENTION

The present invention relates to password re-entry.

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### 2. BACKGROUND ART

The Internet currently has millions of web pages that can be accessed. Some of the web pages require the input of passwords, for instance when creating or accessing a user account. Oftentimes, these passwords reside on a web page that contains other data input fields as well. It is desirable to include password entries and data input fields in the same form.

Sometimes, when errors occur, the web page must be re-transmitted to the user (if a password must be re-entered or if the other data input is incorrect in some way). In the prior art when this occurs, the web page is returned in a form that compromises the password. This problem can be better understood by first reviewing what the Internet is and how it works.

## Internet

The information network known as the "Internet" has become ever increasingly popular. The Internet provides a vast body of information which may be accessed by users via computers for such purposes as business, education, and entertainment. In particular, the Internet includes a large collection of interconnected documents which are stored in computers in a system known as the World Wide Web or simply "the web". The documents are organized into web spaces, where a web space includes a home page and links to other documents which may be in the local web space or in an external web space. Such links are known as hyperlinks. Documents may include moving images, text, graphical displays, and sound.

Internet resources are typically accessed in a two-way environment via a network connection. For example, connectivity to the network may be via a conventional twisted-pair telephone line which has a relatively low data-carrying capacity (e.g., bandwidth), or via a higher bandwidth path, which may comprise optical fiber, coaxial cable, or other transmission mechanism, such as the newly emerging wireless technologies. To retrieve data from a network destination (e.g., an Internet site), a user sends a message to the network destination to request the transfer of information to the user's computer, referred to as a client. The network destination typically includes a computer known as a server. The server then sends a request signal to a source function, which may be a memory which is coupled to the server. The source function includes the user-requested information which may comprise, for example, text, graphics, audio and/or video data. In response to the request signal from the server, the source function provides the requested information to the client.

## HTML

Source information which is stored in the source function is often stored in a format known as "Hypertext Markup Language (HTML)". This file or script format allows the display of text, graphics and audio information, and provides links to other pages of information through "hyperlinks." Hyperlinks are strings of characters in a particular format that specify the address of the desired page of information.

In particular, HTML is a system for marking documents to indicate how the document should be displayed, and how various documents should be linked together. HTML is a form of Standard Generalized Markup Language (SGML), defined by the International Standards Organization. HTML specifies the grammar and syntax of markup tags which are inserted into a data file to define how the data will be presented when read by a computer program known as a "web browser". Conventional web browsers include Internet Explorer, Netscape Navigator, and others.

The data file, which is typically stored on a server, includes one or more web pages which are visited by users who have computers which may run different browsers. When a page is visited, HTML data output from the server is downloaded to the client computer. The client computer's browser processes the data to format a layout for the page so the page can be viewed by the user on a computer screen. Generally, HTML tags provide text formatting, hypertext links to other pages, and links to sound and picture elements. HTML tags also define input fields

for interactive web pages. Another use for HTML is to generate forms. Form HTML allows the web browser to display a plurality of locations in the web page where a user can provide input which can then be transmitted to the server. Often form HTML is useful to process such data as a user ID, a password, a user's address, and a user's phone number, for instance.

An HTML application is made available to users on the web by storing the HTML file in a directory that is accessible to a server. Such a server is typically a web server which conforms to a web browser-supported protocol known as Hypertext Transfer Protocol (HTTP). Servers that conform to other protocols such as the File Transfer Protocol (FTP) or GOPHER may also be used, but do not support interactive HTML files.

HTTP defines a set of rules that servers and browsers follow when communicating with each other. Typically, the process begins when a user accesses an icon in an HTML page which is the anchor of a hyperlink, (for instance, by positioning a cursor on the icon and depressing a mouse button), or the user inputs a Uniform Resource Locator (URL) to his or her web browser, described below. A connection is then made to the server at the address and port number specified by the URL. Next, the browser sends a request to retrieve an object from the server, or to post data to an object on the server. The server sends a response to the browser including a status code and the response data. The connection between the browser and server is then closed.

## URL

A URL is a unique address which identifies virtually all files and resources on the Internet. A URL has the form:

method://server:port/path/file#anchor.

The "method" of accessing the resource is the web browser-supported protocol, and may include, for example, HTTP, FTP, GOPHER, TELNET, NEWS, or MAILTO. The "server:port" indicates the name of the server which is providing the resource, and is alternatively known as the Internet domain name. For example, many businesses will use their business name as part of the server field. The port designation is the port number on the server, but is usually not used since a default port is assumed. The "path" indicates the directory path to the resource. The file indicates the file name of the resource. The "anchor" indicates the named element in the HTML document. Not all fields are required.

Thus, it can be seen that web browsers operate in a two-way communication environment to access information by sending a request signal defined by a URL command to a server, and receiving information in return.

## Password and Data Entry

Most web pages that require a password to be entered normally require the user to enter the password twice, so that a verification can occur as to whether the user has made a

typographical error. In addition, these password fields normally echo characters with a “\*” rather than the original letter, for security purposes. Thus, a person maliciously peering over the shoulder of the user will be unable to determine his or her password.

Referring to Figure 1, web browser 100, includes display area 110 for displaying the HTML output of a web server which in this example is a form. Figure 1 substantially represents the screen of a computer user displaying a form. In operation, the user inputs data to the form, which includes input areas for a user ID 120, other data fields 125-127, a first password field 130, and a second password field 140. After the user has completed inputting data, it will appear substantially as shown in Figure 2. Thus, a user ID entry 200 in the user ID field 120, other data field entries, data1, data2, and data3, (205-207), in other data fields (125-127), a first password entry 210 in the first password field 130, and a second password entry 220 in the second password field 140 have been entered. First and second password entries 210 and 220 are represented as strings of “\*” characters as is common in the prior art.

Take, for example, the case where a user intends his or her password to be “dog”. The user is presented with two fields for password entry, such as fields 130 and 140 of Figure 2. Assume, for instance that the user inputs “dag” into the first field instead of “dog”. The user would see “\*\*\*” and believe the password to be dog. Thus, in the future, the user would be unable to utilize the password because the computer would recognize the password as “dag” while the user believes the password to be “dog”. With the more common two field entry, as in Figures 1 and 2, the computer will obviate this problem because the two differing entries will indicate that a typographical error has been made. Thus, fields 130 and 140 will display only

strings of "\*" characters, but by comparing the actual characters of the strings, the server will determine that an error occurred and notify the user.

### Re-sending Forms

In the prior art, when an error occurs in a two field password entry, or another type of error occurs, such as an invalid user ID entry 200, or an invalid other type of data entry 205-207, one solution is for the server to re-send the form and prompt the user to fill out the form again. The re-sent page is exemplified by Figure 3, which includes error message 300, which prompts the user to fill out the form again.

Note that all data entries from Figure 2 have been removed from the re-sent form. While this solution does not compromise the password, it is disadvantageous because if user ID field 120, or other data fields 125-127 were entered correctly, they must be-re-entered again. This can be time consuming and unnecessarily repetitive for users, often causing them to forego filling out the form altogether. In addition, many forms are extremely detailed and could have hundreds of other field entries, many of them comprising large blocks of text. Forcing a re-entry because of a mistyped letter in a password or other data field is disadvantageous.

To avoid forcing a re-entry of the entire form, one prior art solution causes the server to construct a new HTML form document, such as the document described in connection with Figure 4. In reconstructing the document, the server generates HTML code. The code can



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## SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for password re-entry. In one or more embodiments, the invention is in an environment wherein a password and data are inputted into the same document. In one embodiment, this environment is the Internet where a web browser displays the output of a web server in a form HTML document.

The invention removes the prior art risk associated with returning a web page with the password entries in clear text. When returning a password, the invention generates two unique identifiers that represent the entries in the two password fields. Next, the invention re-constructs the form by including previously entered data in the new form and by substituting the two unique identifiers for the password fields.

In one embodiment, the user can edit the password by modifying the unique identifier string. The original text of the password remains safely on the server. If the password is edited, the server compares the unique identifier strings re-sent in the encoded web page with the returned web page. In this way, the server detects a modified password while still maintaining the secrecy of the password.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying drawings where:

Figure 1 is a diagram of a conventional web browser displaying a form having two password entry fields.

Figure 2 is a diagram of a conventional web browser displaying a form, where the data fields have been input.

Figure 3 is a diagram of a conventional web browser displaying a returned document.

Figure 4 is a diagram of a conventional web browser displaying a returned document having view source functionality.

Figure 5 is a flowchart of re-sending a form in accordance with an embodiment of the present invention.

Figure 6 is a diagram of re-sending a form in accordance with an embodiment of the present invention.

Figure 7 is a diagram of password re-entry in accordance with an embodiment of the present invention.

Figure 8 is a flowchart of password re-entry in accordance with an embodiment of the present invention.

Figure 9 is a block diagram of an embodiment of a computer system capable of providing a suitable execution environment for an embodiment of the invention.

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## DETAILED DESCRIPTION OF THE INVENTION

The invention is a method and apparatus for password re-entry. In the following description, numerous specific details are set forth to provide a more thorough description of embodiments of the invention. It is apparent, however, to one skilled in the art, that the invention may be practiced without these specific details. In other instances, well known features have not been described in detail so as not to obscure the invention.

The operation of the present invention is illustrated in Figure 5. The operation comprises generating a first unique identifier from a first password field (step 500), generating a second unique identifier from a second password field (step 510) and re-constructing the document by substituting the first and second unique identifiers from the original password entries (step 520).

### Unique Identifier Generation

With reference to steps 500 and 510 of Figure 5, the following technique is used in one embodiment of the present invention to generate unique identifiers for the entered password fields. A string is substituted for the password. For instance, the strings "abcd" and "ABCD" can be the password field entries in the re-sent page, where the string length is the same as the original password. The re-sending of a password field encoded with a unique identifier is described in connection with Figure 6, where encoded unique identifiers 600 and 610 are re-sent in password fields 130 and 140. Note however, that unique identifiers 600 and 610 are not

[illegible]

### Password Re-entry

In one embodiment, the re-sent form of Figure 6 also allows the user to modify the password in a secure way. The user can change the password by adding or inserting characters into both copies of the password fields 130 and 140. Password modification is described in connection with Figure 7. For instance, if the user had previously intended the password to be “live”, then password fields 130 and 140 would originally have contained the term “live”. Upon re-sending the page, the server encodes password fields 130 and 140 with the strings “abcd” and “ABCD”, for example, which are the same string length as “live”.

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After entering the new passwords, the user can re-submit the document. Upon re-submission, the server compares the password fields. By comparing the strings "abcd" and "ABCD" with re-entered password entries "abcde" 700 and "ABCDs" 710, the server will detect new or deleted characters in the password fields by comparing the position of the trace letters ("abcd . . ." and "ABCD . . .") in the fields. Thus, the server will determine that the character "s" has been added and will change the password to "lives". Alternatively, the user may re-type the entire password, in which case the server will determine that the entire encoded string has been modified and replaced with a new password.

Figure 8 is a flowchart of password re-entry in accordance with an embodiment of the present invention. At step 800, the invention determines whether the form has been correctly filled out. If the form has been correctly filled out, no further action is necessary. If the form has not correctly been filled out, the invention re-constructs all fields of the form at step 810, except the password fields. At step 820, the invention generates a first unique identifier from the first password field. At step 830, the invention generates a second unique identifier from the second password field. At step 840, the invention substitutes the first and second unique identifiers for the original password field entries. Next, the invention re-examines the form upon re-submission by the user at step 850. At step 860, the invention determines whether the unique identifiers have changed. If the unique identifiers have changed, the invention determines the new password at step 870.

**SECRET**

### Embodiment of Computer Execution Environment (Hardware)

Computer 900 includes a video memory 914, main memory 915 and mass storage 912, all coupled to bi-directional system bus 918 along with keyboard 910, mouse 911 and processor 913. The mass storage 912 may include both fixed and removable media, such as magnetic, optical or magnetic optical storage systems or any other available mass storage technology. Bus



918 may contain, for example, thirty-two address lines for addressing video memory 914 or main memory 915. The system bus 918 also includes, for example, a 32-bit data bus for transferring data between and among the components, such as processor 913, main memory 915, video memory 914 and mass storage 912. Alternatively, multiplex data/address lines may be used instead of separate data and address lines.

In one embodiment of the invention, the processor 913 is a microprocessor manufactured by Motorola, such as the 680X0 processor or a microprocessor manufactured by Intel, such as the 80X86, or Pentium processor, or a SPARC microprocessor from Sun Microsystems, Inc. However, any other suitable microprocessor or microcomputer may be utilized. Main memory 915 is comprised of dynamic random access memory (DRAM). Video memory 914 is a dual-ported video random access memory. One port of the video memory 914 is coupled to video amplifier 916. The video amplifier 916 is used to drive the cathode ray tube (CRT) raster monitor 917. Video amplifier 916 is well known in the art and may be implemented by any suitable apparatus. This circuitry converts pixel data stored in video memory 914 to a raster signal suitable for use by monitor 917. Monitor 917 is a type of monitor suitable for displaying graphic images.

Computer 900 may also include a communication interface 920 coupled to bus 918. Communication interface 920 provides a two-way data communication coupling via a network link 921 to a local network 922. For example, if communication interface 920 is an integrated services digital network (ISDN) card or a modem, communication interface 920 provides a data communication connection to the corresponding type of telephone line, which comprises part of

network link 921. If communication interface 920 is a local area network (LAN) card, communication interface 920 provides a data communication connection via network link 921 to a compatible LAN. Wireless links are also possible. In any such implementation, communication interface 920 sends and receives electrical, electromagnetic or optical signals which carry digital data streams representing various types of information.

Network link 921 typically provides data communication through one or more networks to other data devices. For example, network link 921 may provide a connection through local network 922 to local server computer 923 or to data equipment operated by an Internet Service Provider (ISP) 924. ISP 924 in turn provides data communication services through the world wide packet data communication network now commonly referred to as the "Internet" 925. Local network 922 and Internet 925 both use electrical, electromagnetic or optical signals which carry digital data streams. The signals through the various networks and the signals on network link 921 and through communication interface 920, which carry the digital data to and from computer 900, are exemplary forms of carrier waves transporting the information.

Computer 900 can send messages and receive data, including program code, through the network(s), network link 921, and communication interface 920. In the Internet example, remote server computer 926 might transmit a requested code for an application program through Internet 925, ISP 924, local network 922 and communication interface 920.

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